



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Cotton-leaf Analytical Test for the Mid-South U.S. To Prevent the
Over-application of Nitrogen Fertilizer

Duration: From September 1, 1996 to August 31, 1997

Fiscal year 1996 Federal funds: \$39,600

Non-federal funds allocated: \$79,200

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Congressional districts of universities performing the research: Alabama 3rd Arkansas 1st
Louisiana 6th Mississippi 3rd

Statement of the critical regional water problems:

Project to address Southeastern/Island region priorities of water quality and non-point source pollution: Nitrogen (N) fertilization is a required practice for the millions of hectares of cotton (*Gossypium hirsutum* L.) in the Mid-South USA. Cotton is a heavy feeder of N and the most important element in its nutrition. Over application of N is a small expense compared to land or insect control and it can be argued that over fertilization is a reasonable method of preventing potential N deficiencies. Nitrogen fertilization is an unregulated practice in almost all of the U.S. The over application of this element to crops has produced pollution of groundwaters, and it is suspected to be the source of the nitrate-nitrogen implicated in the cause of the dead zone in the Gulf of Mexico. The high frequency of rainfall in the humid south make the leaching potential of N in Mississippi-River alluvial soil a major problem. Nitrate-N may leach to groundwaters when fertilizer application exceeds plant needs or if fertilizer application is not matched to plant uptake. Methods in use today to predict the N status of cotton are either inaccurate or were derived from surveys without accuracy verification. The proposed project will calibrate a promising, but unproven, analytical tool to assess the N status of cotton and prevent unneeded N applications and the leaching of N to groundwaters.

Fertilization experiments done by the Pls have shown that Louisiana cotton requires a one-time application of 70 to 110 kg/ha of N applied near planting for cotton on silt loam or similar soils. Many farmers apply more N than is needed and others supplement an initial adequate application of N with unneeded mid-season applications. Mid-season applications are recommended as a regular practice by some fertilizer dealers and are required in a few cases when N has been leached from the root zone or during a drought. Mid-season N applications are often unnecessary and may result in N leaching below the root zone. Analytical tools are needed to determine if cotton is N deficient at mid-season and if N applications are needed. Soil tests have not proven reliable in predicting the amount of N available to cotton because of the humid-South conditions of low organic matter soils, high capacity for buffering ammonium-N in the soils, complexity of N transformations in the soil biosphere, and erratic weather conditions. Analyses of the cotton leaf, however, may be an effective tool for assessing cotton N status. The accuracy of a cotton-leaf diagnostic method has been tested only in a few preliminary studies.

Statement of results, benefits, and information expected from project:

Over fertilization of cotton and nitrate leaching to groundwaters from cotton fields will be lessened if growers are given tools produced from this proposal. Now, growers do not have an accurate quantitative measure of the N status of cotton at early or mid-season. Considerable mid-season N fertilization occurs despite research that indicates these applications do not *often* increase yields. This study provides evidence that will be evaluated by our peers, growers, Extension personnel, and regulatory agencies and judged as to the test's efficacy in predicting the N status of cotton. Information from this project is essential in conferring credibility or rejection of our mid-season N test.

The tissue test from this project will be valuable for University Extension personnel, and if needed in the future, regulatory agencies. Efficient use of N is not as high of a priority with some farmers as is insect control or marketing. Nitrogen fertilizer costs for cotton are about \$74/hectare while the total cost for producing a hectare of Louisiana cotton is about \$1,200 with \$100 for insect control. Over application of N can be insurance against a deficiency or a result of faulty recommendations from consultants. University extension personnel need this test to help educate growers in the efficient, and pollution-free use of N. Regulator agencies may need this monitoring tool to determine if N fertilization is recommended.